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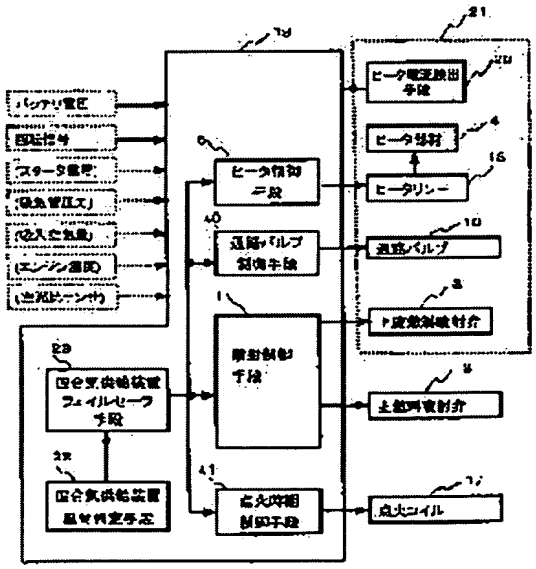
(54) DEVICE AND METHOD FOR DIAGNOZING AIR-FUEL MIXTURE SUPPLY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a device and a method for diagnozing an air-fuel mixture supply device capable of judging that the air-fuel mixture supply device is abnormal if air-fuel mixture by the air-fuel mixture supply device is abnormal, ensuring at least engine start, performing the operation of an engine continuously without causing a problem reaching engine stall, and preventing worsening of exhaust gas.

SOLUTION: This device for diagnozing the air-fuel mixture supply device is provided with an air-fuel mixture condition detection means for detecting a condition of air-fuel mixture when a vaporization means operates and air-fuel mixture is supplied from an air-fuel mixture supply means and a judging means for judging abnormality of the air-fuel mixture supply means based on the results of detection of the air-fuel mixture condition detection means.



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CLAIMS

[Claim(s)]
[Claim 1] The main-fuel injection valve which supplies a fuel to an internal combustion engine, In a feeder the gaseous mixture which supplies gaseous mixture from the upstream of said main-fuel injection valve with an evaporation means to evaporate all or some of fuel supplied from the upper fuel injection valve which supplies a fuel to the upstream from said main-fuel injection valve, and said upper fuel injection valve -- the gaseous mixture of the internal combustion engine having a supply means -- the condition that said evaporation means operated -- said gaseous mixture -- the gaseous mixture which detects the condition of gaseous mixture when supplying gaseous mixture from the supply means -- with a condition detection means said gaseous mixture -- the detection result of a condition detection means -- being based -- said gaseous mixture -- the gaseous mixture characterized by having a judgment means to judge the abnormalities of a supply means -- the diagnostic equipment of a feeder.
[Claim 2] The main-fuel injection valve which supplies a fuel to an internal combustion engine, and the upper fuel injection valve which supplies a fuel to the upstream from said main-fuel injection valve, By the heater member which heats and evaporates all or some of fuel supplied from said upper fuel injection valve, and the heater control means which performs energization control of said heater member the gaseous mixture of the internal combustion engine which supplies gaseous mixture from the upstream of said main-fuel injection valve -- in a feeder in the condition of having energized to said heater member by said heater control means A mixed gaseous state voice detection means to detect the condition of the gaseous mixture formed when supplying the fuel from said upper fuel injection valve, said gaseous mixture -- the gaseous mixture characterized by having a judgment means to judge the abnormalities of both said upper fuel injection valve, and said heater both [any one or], based on the detection result of a condition detection means -- the diagnostic equipment of a feeder.
[Claim 3] said gaseous mixture -- a condition detection means -- the inside of an engine rotational frequency, the pressure-of-induction-pipe force, a firing pressure, torque value, an exhaust-gas temperature, HC concentration, NOx concentration, and CO concentration -- at least one detection result -- being based -- gaseous mixture -- the gaseous mixture according to claim 1 or 2 characterized by detecting a condition -- the diagnostic equipment of a feeder.

[Claim 4] said judgment means -- said gaseous mixture -- the gaseous mixture according to claim 1 or 2 characterized by what is judged based on at least one of the absolute value of the detection result of a condition detection means, variation, rate of change, the amount of deflection from the desired value set up beforehand, and fluctuation surges -- the diagnostic equipment of a feeder.
[Claim 5] The increment in the fuel which decreases the quantity of or suspends the fuel supplied from said upper fuel injection valve, and is supplied from said main-fuel injection valve when judged with it being unusual by said judgment means, or the change to said main-fuel injection valve, It has further the fail-safe control means which performs halt of said evaporation means and amendment of ignition timing. Aggravation of said internal combustion engine's operational status, the gaseous mixture according to claim 1 characterized by using said fail-safe control means so that both both [any one or] in a harmful exhaust gas discharge may be controlled -- the diagnostic equipment of a feeder.
[Claim 6] The increment in the fuel which decreases the quantity of or suspends the fuel supplied from said upper fuel injection valve, and is supplied from said main-fuel injection valve when judged with it being unusual by said judgment means, or the change to said main-fuel injection valve, It has further the fail-safe control means which performs halt of the energization to said heater member, and amendment of ignition timing. Aggravation of said internal combustion engine's operational status, the gaseous mixture according to claim 2 characterized by using said fail-safe control means so that both both [any one or] in a harmful exhaust gas discharge may be controlled -- the diagnostic equipment of a feeder.
[Claim 7] When said main-fuel injection valve performs fuel injection at least during starting cranking and engine rotational speed exceeds a predetermined value, Or when judged with it being normal by main-fuel supply judging means to judge with the fuel supply by said main ******** being normal when the pressure-of-induction-pipe force becomes below a predetermined value, and said main-fuel supply judging means While decreasing the quantity of or suspending the fuel supplied from said mainstream fuel injection valve the gaseous mixture according to claim 1 characterized by having further the fuel-supply modification means which performs the increment in the fuel supplied from said upper fuel injection valve, or the change to said upper fuel injection valve, and operates said evaporation means -- the diagnostic equipment of a feeder.
[Claim 8] When said main-fuel injection valve performs fuel injection at least during starting cranking and engine rotational speed exceeds a predetermined value, Or when judged with it being normal by main-fuel supply judging means to judge with the fuel supply by said main ******** being normal when the pressure-of-induction-pipe force becomes below a predetermined value, and said main-fuel supply judging means While decreasing the quantity of or suspending the fuel supplied from said mainstream fuel injection valve the gaseous mixture according to claim 2 characterized by having further a fuel-supply modification means to perform the increment in the fuel supplied from said upper fuel injection valve, or the change to said upper fuel injection valve, and to perform

energization to said heater member -- the diagnostic equipment of a feeder.
[Claim 9] After being judged with the supplementary air path [which bypasses a throttle valve], supplementary air path bulb [which adjusts the air content of said supplementary air path], and said internal combustion engine's starting back A target revolving-speed-control means to control said supplementary air path bulb to become a predetermined target engine speed, The ignition timing control means which controls ignition timing to a lag side when supplying the fuel from said upper fuel injection valve at least, It is based on the detection result of said mixed gaseous state voice detection means in the condition that said ignition timing is controlled at the lag side. gaseous mixture given in claims 1 and 5 characterized by having further a judgment means to judge any one or two or more abnormalities of said upper fuel injection valve, said evaporation means, and said supplementary air path bulb, or any 1 term of 7 -- the diagnostic equipment of a feeder.
[Claim 10] After being judged with the supplementary air path [which bypasses a throttle valve], supplementary air path bulb [which adjusts the air content of said supplementary air path], and said internal combustion engine's starting back A target revolving-speed-control means to control said supplementary air path bulb to become a predetermined target engine speed, The ignition timing control means which controls ignition timing to a lag side when supplying the fuel from said upper fuel injection valve at least, It is based on the detection result of said mixed gaseous state voice detection means in the condition that said ignition timing is controlled at the lag side. gaseous mixture given in claims 2 and 6 characterized by having further a judgment means to judge any one or two or more abnormalities of said upper fuel injection valve, said heater member, and said supplementary air path bulb, or any 1 term of 8 -- the diagnostic equipment of a feeder.
[Claim 11] the gaseous mixture according to claim 9 or 10 characterized by said ignition timing control means performing lag control of ignition timing in a predetermined step -- the diagnostic equipment of a feeder.
[Claim 12] said gaseous mixture -- a condition detection means -- any one or two or more detection results of an inhalation air content, a supplementary air path bulb controlled variable, and fuel oil consumption -- being based -- gaseous mixture -- the gaseous mixture according to claim 9 or 10 characterized by detecting a condition -- the diagnostic equipment of a feeder.
[Claim 13] the time of being judged with there not being a means to judge degradation of a dc-battery, and degradation of a dc-battery, and supplying the fuel from said upper fuel injection valve -- the detection result of battery voltage -- being based -- said gaseous mixture -- the gaseous mixture according to claim 1 characterized by judging the abnormalities of a supply means -- the diagnostic equipment of a feeder.
[Claim 14] said gaseous mixture -- the detection result of said heater current detection means after a condition detection means starts the energization to a heater current detection means to detect the current value energized to said heater member, and said

to fuel oil consumption -- being based -- gaseous mixture -- the gaseous mixture according to claim 2 characterized by detecting a condition -- the diagnostic equipment of a feeder.
[Claim 15] the gaseous mixture according to claim 1, 2, or 13 characterized by having both an abnormality storage means to memorize abnormalities when judged with abnormalities by said judgment means, and abnormality warning both [any one or] to warn of abnormalities -- the diagnostic equipment of a feeder.
[Claim 16] gaseous mixture given in claim 1 characterized by said evaporation means being at least one of the evaporation at an electric-type heater, the heater evaporation by combustion, the evaporation by supersonic vibration, the evaporation by warm water use, and the evaporation by exhaust-gas-temperature use, or any 1 term of 5 -- the diagnostic equipment of a feeder.
[Claim 17] The main-fuel injection valve which supplies a fuel to an internal combustion engine, It is the diagnostic approach of a feeder. the gaseous mixture which supplies gaseous mixture from the upstream of said main-fuel injection valve with an evaporation means to evaporate all or some of fuel supplied from the upper fuel injection valve which supplies a fuel to the upstream from said main-fuel injection valve, and said upper fuel injection valve -- the gaseous mixture of the internal combustion engine having a supply means -- the condition that said evaporation means operated -- said gaseous mixture -- the step which detects the condition of gaseous mixture when supplying gaseous mixture from the supply means, and said detection result -- being based -- said gaseous mixture -- the gaseous mixture characterized by having the step which judges the abnormalities of a supply means -- the diagnostic approach of a feeder.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention -- gaseous mixture -- the gaseous mixture which supplies gaseous mixture to a detail from the upstream of a main-fuel injection valve about the diagnostic equipment and its diagnostic approach of a feeder -- the gaseous mixture of the internal combustion engine which established the supply means -- it is related with amelioration of the fault read-out unit of a feeder, its diagnostic approach, and its fail-safe.
[0002]
[Description of the Prior Art] By heating and evaporating as a Prior art at the heater which prepared the fuel injected by the fuel injection valve in the inhalation-of-air path, the fuel adhering to an inhalation-of-air path or an inlet valve is reduced, and the method which aims at reduction of the discharge of a harmful hydrocarbon is especially proposed as the combustion improvement at the time of cold machine starting. for example, the fuel injection valve (main-fuel injection valve) prepared near the suction port of each gas column in United States patent No.5894832 -- in addition, the configuration which arranges a fuel injection valve (upper fuel injection valve) and a heater to the

supplementary air path which bypasses the throttle valve of the upstream performs fuel injection towards a heater from an upper fuel injection valve in the warming-up process after cold machine starting, and there are some which prevent fuel adhesion to an inhalation-of-air path, and aim at a combustion improvement by promoting fuel evaporation at a heater.

[0003] moreover, the thing for which an evaporation fuel is supplied into a cylinder by the above-mentioned well-known example -- gaseous mixture -- since formation becomes good and a combustion improvement effect is acquired, even if it enlarges the amount of lags of ignition timing to the conventional engine without a heater by the idle after starting, it can stabilize and burn. Therefore, while carrying out the heating evaporation of the fuel at a heater, the amount of lags of ignition timing is enlarged, an exhaust-gas temperature is raised, and there is an advantage that the discharge of a harmful hydrocarbon (HC) can be reduced after cold machine starting, by promoting the activity of a catalyst. Furthermore, by the above-mentioned well-known example, the approach of carrying out an abnormality judging with the heater current value in the case of having the heater current detection means is also proposed.

[0004] Moreover, although the combustion improvement at the time of cold machine starting is not the purpose, the combustion improvement effect in a direct injection jump-spark-ignition type internal combustion engine's high rotation and heavy load field especially by homogeneity inhalation of air is aimed at. In JP,2000-213398,A and JP,2000-274296,A In the fuel-injection control unit which established the change control means which makes fuel supply share with the main-fuel injection valve which injects a direct fuel to a combustion chamber, and the auxiliary fuel injection valve which can supply a fuel in an inhalation-of-air path As a means to diagnose failure of an auxiliary fuel injection valve, the method diagnosed based on the air-fuel ratio detected in high rotation and a heavy load region is proposed in the predetermined service condition and the example.

[0005]

[Problem(s) to be Solved by the Invention] however, such conventional gaseous mixture -- if it was in the feeder, there were the following troubles. In the above-mentioned United States patent, since combustion is improved with the fuel which was made to adhere to a heater and was evaporated when supplying a fuel from an upper fuel injection valve, the injection by the side of a main-fuel injection valve is used, stopping mostly. Moreover, when it deteriorates in the degree of pole of a heater by detecting the heater current, or when the current supply system to a heater is disconnected, it can detect about the phenomenon of appearing notably as abnormalities of the heater current. However, in the abnormalities of the upper fuel injection valve of channel area decreasing, for example by mixing and deposition of cutoff of the fuel-supply path to an upper fuel injection valve, or the foreign matter to a fuel injection valve, and fuel oil consumption decreasing, even if normal as halfway degradation of the heater engine performance, or heater engine

since enough evaporation fuels were no longer supplied while not having been judged with it being unusual by it, the improvement effect of combustion was no longer demonstrated and there were an increment in the discharge of a hydrocarbon and a problem of resulting in an engine stall, without the ability carrying out the worst combustion.

[0006] the gaseous mixture which equipped it with the upper fuel injection valve after starting to the operating period which includes starting cranking especially by the main-fuel injection valve independent -- the case where it considers as the operational status considered as independent injection of a feeder -- gaseous mixture, such as abnormalities of the above heaters or upper fuel injection valves, -- since it resulted in the engine stall to the timing of a coincidence term mostly with an engine beginning to rotate by himself when there were abnormalities of a feeder, there was a problem that where of the worst transit could not be carried out.

[0007] moreover, with the technique of a publication, to JP,2000-213398,A and JP,2000-274296,A Since the combustion improvement effect in the high rotation and the heavy load field by a direct injection jump-spark-ignition type internal combustion engine's homogeneity inhalation of air is aimed at The change control means which an auxiliary fuel injection valve is operated and is made to share with a main-fuel injection valve It is a setup in high rotation and a heavy load field, and it sets up beforehand so that an air-fuel ratio when fuel injection of the air-fuel ratio at the time of using together an auxiliary fuel injection valve and a main-fuel injection valve is carried out only from richness and a main-fuel injection valve may serve as Lean. Therefore, if the air-fuel ratio only in the case of a main-fuel injection valve is also set as weak Lean, since change of combustion does not change extremely, there is no aggravation of operability which an operator senses as a shock, and it can also detect by change of an air-fuel ratio. however, gaseous mixture -- the case where it sees by the feeder independent -- gaseous mixture -- since aggravation of operability will be easy to be recognized if a feeder breaks down, it is necessary to detect aggravation of a combustion condition quickly In detection by the air-fuel ratio sensor, since O2 concentration is mainly detected, the output by the side of Lean may be carried out also in the state of a flame failure in property, and there is a trouble that abnormalities cannot be detected if the ratio of a fuel suits air as an air-fuel ratio even when unsuitable as gaseous mixture. Moreover, in an operating period including starting cranking, since an engine began to have rotated by himself, combustion was the transient field which carries out big change, it was difficult to detect aggravation of a combustion condition quickly, and there was a trouble of incorrect-detecting in diagnosing based on an air-fuel ratio.

[0008] the place which this invention is made in view of said technical problem, and is made into the purpose -- gaseous mixture -- the gaseous mixture which it can judge with abnormalities, and there are not reservation of engine starting and a problem which results in an engine stall at least, and operation of an engine can be continued, and can prevent aggravation of exhaust gas when abnormalities are in the gaseous mixture by the

[Means for Solving the Problem] said purpose -- it should attain -- the gaseous mixture of this invention -- the diagnostic equipment of a feeder The main-fuel injection valve which supplies a fuel to an internal combustion engine fundamentally, and the upper fuel injection valve which supplies a fuel to the upstream from said main-fuel injection valve, In a feeder the gaseous mixture which supplies gaseous mixture from the upstream of said main-fuel injection valve with an evaporation means to evaporate all or some of fuel supplied from said upper fuel injection valve -- the gaseous mixture of the internal combustion engine having a supply means -- the condition that said evaporation means operated -- said gaseous mixture -- the gaseous mixture which detects the condition of gaseous mixture when supplying gaseous mixture from the supply means -- a condition detection means and said gaseous mixture -- the detection result of a condition detection means -- being based -- said gaseous mixture -- it is characterized by having a judgment means to judge the abnormalities of a supply means.

[0010] moreover, the gaseous mixture of this invention -- the diagnostic equipment of a feeder The main-fuel injection valve which supplies a fuel to an internal combustion engine fundamentally, and the upper fuel injection valve which supplies a fuel to the upstream from said main-fuel injection valve, By the heater member which heats and evaporates all or some of fuel supplied from said upper fuel injection valve, and the heater control means which performs energization control of said heater member the gaseous mixture of the internal combustion engine which supplies gaseous mixture from the upstream of said main-fuel injection valve -- in a feeder in the condition of having energized to said heater member by said heater control means A mixed gaseous state voice detection means to detect the condition of the gaseous mixture formed when supplying the fuel from said upper fuel injection valve, It is characterized by having a judgment means to judge the abnormalities of both said upper fuel injection valve, and said heater both [any one or], based on the detection result of said mixed gaseous state voice detection means.

[0011] moreover, the gaseous mixture concerning this invention -- the concrete mode of the diagnostic equipment of a feeder Said evaporation means is made into a heater member and a heater control means. Said mixed gaseous state voice detection means An engine rotational frequency, the pressure-of-induction-pipe force, a firing pressure, torque value, an exhaust-gas temperature, HC concentration, Based on any one of NOx concentration and the CO concentration, or two or more detection results, a judgment means to detect mixed gaseous state voice and to judge said abnormalities It constituted so that it might judge based on any one or the plurality of the absolute value of the detection result of said mixed gaseous state voice detection means, variation, rate of change, the amount of deflection from the desired value set up beforehand, and a fluctuation surge.

[0012] the gaseous mixture concerning this invention constituted like the above-mentioned -- the diagnostic equipment of a feeder gaseous mixture -- the abnormalities of the heater relation by reduction of the evaporation fuel with which a feeder is supplied from the upper fuel injection valve by degradation of a heater, open circuit of the current supply system to

gaseous state voice and has been beforehand set up when abnormal as gaseous mixture / -- channel area decreases by mixing and deposition of cutoff of the fuel-supply path to an upper fuel injection valve or the foreign matter to a fuel injection valve, and fuel oil consumption decreases --] is exceeded, it judges with it being unusual.

[0013] moreover, the gaseous mixture of this invention -- the diagnostic equipment of a feeder The increment in the fuel which decreases the quantity of or suspends the fuel supplied from said upper fuel injection valve, and is supplied from said main-fuel injection valve when judged with it being unusual by said judgment means, or the change to said main-fuel injection valve, Or it has further the fail-safe control means performed gradually. a halt of said evaporation means or a halt of the energization to said heater member, and amendment of ignition timing -- immediately -- with said internal combustion engine's operational status It is characterized by using said fail-safe control means so that aggravation of both exhaust gas both [any one or] may be controlled. the gaseous mixture concerning this invention constituted like the above-mentioned -- the diagnostic equipment of a feeder can prevent reservation of engine starting, an engine's continuation of operation, and aggravation of exhaust gas at least.

[0014] moreover, the gaseous mixture of this invention -- the diagnostic equipment of a feeder When said main-fuel injection valve performs fuel injection at least during starting cranking and engine rotational speed exceeds a predetermined value, Or when judged with it being normal by main-fuel supply judging means to judge with the fuel supply by said main ******** being normal when the pressure-of-induction-pipe force becomes below a predetermined value, and said main-fuel supply judging means While decreasing the quantity of or suspending the fuel supplied from said mainstream fuel injection valve It is characterized by having further a fuel-supply modification means to perform the increment in the fuel supplied from said upper fuel injection valve, or the change to an upper fuel injection valve, and to perform actuation of said evaporation means, or energization to said heater member.

[0015] the gaseous mixture concerning this invention constituted like the above-mentioned -- since it diagnoses by switching to an upper fuel injection valve when judged with said main-fuel supply means judging by the main-fuel injection valve of the diagnostic equipment of a feeder being normal at least -- the abnormalities of said main-fuel supply means -- gaseous mixture -- it can prevent that the abnormality judging of a supply means carries out a misjudgment law in response to effect.

[0016] moreover, the gaseous mixture of this invention -- the diagnostic equipment of a feeder After being judged with the supplementary air path [which bypasses a throttle valve], supplementary air path bulb [which adjusts the air content of said supplementary air path], and said internal combustion engine's starting back A target revolving-speed-control means to control said supplementary air path bulb to become a predetermined target engine speed, The ignition timing control means which controls ignition timing to a lag side when supplying the fuel from said upper fuel injection valve at least, Said ignition timing is characterized by having further a judgment means to judge

any one or two or more abnormalities of said upper fuel injection valve, a heater member, and a supplementary air path bulb, based on the detection result of said mixed gaseous state voice detection means in the condition of being controlled at the lag side. the gaseous mixture concerning this invention constituted like the above-mentioned -- since the diagnostic equipment of a feeder can perform the judgment of whenever [degradation], detecting the combustion condition over the amount of lags of ignition timing, it can prevent the increment in the extreme discharge of a hydrocarbon, and resulting in the worst engine stall.

[0017] Moreover, other concrete modes of this invention are characterized by said ignition timing control means performing lag control of ignition timing in a predetermined step. Moreover, other concrete modes of this invention are characterized by detecting said mixed gaseous state voice detection means based on any one or two or more detection results of an air content, a supplementary air path bulb controlled variable, and fuel oil consumption. moreover, the time of being judged with other concrete modes of this invention not having a means to judge degradation of a dc-battery, and degradation of a dc-battery, and supplying the fuel from said upper fuel injection valve -- the detection result of battery voltage -- being based -- said gaseous mixture -- it is characterized by judging the abnormalities of a supply means.

[0018] Moreover, it is characterized by said mixed gaseous state voice detection means detecting mixed gaseous state voice based on the detection result of said heater current detection means after starting the energization to a heater current detection means to detect the current value energized to said heater member, and said heater member, and the failure set point of the heater current beforehand set up according to fuel oil consumption in other concrete modes of this invention. Moreover, other concrete modes of this invention are characterized by having both an abnormality storage means to memorize abnormalities, and abnormality warning both [any one or] to warn of abnormalities, when judged with it being unusual by said judgment means. Moreover, other concrete modes of this invention are characterized by said evaporation means being at least one of the evaporation at an electric-type heater, the heater evaporation by combustion, the evaporation by supersonic vibration, the evaporation by warm water use, and the evaporation by exhaust-gas-temperature use.

[0019] moreover, the gaseous mixture concerning this invention -- the diagnostic approach of a feeder The main-fuel injection valve which supplies a fuel to an internal combustion engine, It is the diagnostic approach of a feeder. the gaseous mixture which supplies gaseous mixture from the upstream of said main-fuel injection valve with an evaporation means to evaporate all or some of fuel supplied from the upper fuel injection valve which supplies a fuel to the upstream from said main-fuel injection valve, and said upper fuel injection valve -- the gaseous mixture of the internal combustion engine having a supply means -- the condition that said evaporation means operated -- said gaseous mixture -- the step which detects the condition of gaseous mixture when supplying gaseous mixture from the supply means, and said detection result -- being based -- said gaseous mixture -- it is

characterized by having the step which judges the abnormalities of a supply means.
[0020]
[Embodiment of the Invention] the following and a drawing -- the gaseous mixture of this invention -- 1 operation gestalt of the diagnostic equipment of a feeder and its diagnostic approach is explained to a detail.
[0021] drawing 1 -- the gaseous mixture of an operation gestalt -- it is drawing having shown the engine structure of a system equipped with the diagnostic equipment of a feeder. In drawing 1 , 100 is an engine and the inhalation air content sensor 7 and a throttle valve 8 are formed in the inhalation-of-air path 6 of an engine 100. The main-fuel injection valve 2 is formed in the suction-port inlet port of each cylinder. The upper fuel injection valve 3 which is a high atomization injection valve of an air assistant type, and the air for fuel atomization are incorporated in the upper section of the inhalation-of-air path 6 from the upstream of a throttle valve 8, and the air duct 11 supplied to the upper fuel injection valve 3 is formed in it. Generally, if the particle size of an injection fuel is atomized to about 10 microns, flowing into a cylinder will be known without a fuel adhering to an inhalation-of-air path, and the injection fuel of the upper fuel injection valve 3 will be atomized by about 10 microns so that the fuel adhering to the inhalation-of-air path 6 may decrease.
[0022] The heater member 4 (evaporation means) is formed in the injection direction of the upper fuel injection valve 3. The PTC (positive thermistor) heater which can keep temperature constant can be used for the heater member 4. A PTC heater is a heater of self-generation of heat and an autogenous regulation mold which is going to make own joule calorific value of a PTC heater increase automatically, and is going to make it hold heater temperature uniformly and which operates, even if an ambient temperature falls. Operating temperature is uniquely decided by the ingredient presentation, and is selectable among 100-300 degrees C. Moreover, the Curie point is also freely changed by changing the presentation of the PTC ceramic which constitutes a PTC heater. A current is supplied to this heater member 4 through the heater relay 13 from a dc-battery 12. The heater current is detected by the terminal voltage of the resistance 20 (heater current detection means) for current detection.
[0023] Moreover, the supplementary air path control bulbs 10, such as an inflation valve which opens and closes a path in the idle speed control valve (henceforth an ISC bulb) which adjusts the amount of the supplementary air, or ON and OFF, are formed in the supplementary air path 9 which bypasses a throttle valve 8.
[0024] Here, as for the supplementary air path 9, an outlet configuration is formed so that airstream may go to the heater member 4. Although there is some dispersion in the fuel particle size of the upper fuel injection valve 3 and a part of fuel particle with a big particle size also exists, the fuel particle with a particle size small among the fuels injected from the upper fuel injection valve 3 is carried down-stream by airstream, and flows into a direct cylinder. For this reason, only a fuel particle with a big particle size makes it adhere to adhere to the heater member 4, and it is evaporated.

[0025] the above-mentioned upper fuel injection 3, the supplementary air path 9, the path bulb 10, an air duct 11, the heater member 4, and the resistance 20 for heater current detection -- gaseous mixture -- a feeder 21 is constituted. It is mixed with the fuel injected from the fuel injection valve (injector) 2 arranged in the upstream of a gas column, and the air in which the flow of [air] was controlled by the throttle valve 8, and evaporation promotion was carried out by the heater member 4 supplies and burns at each gas column.
[0026] The exhaust gas of the fuel which burned in said each gas column is led to a catalytic converter (illustration abbreviation) through an exhaust pipe 31, and after being purified, it is discharged. The oxygen density sensor 32 which outputs a linear air-fuel ratio signal to an exhaust pipe 31 to an exhaust air air-fuel ratio is arranged suitably in the location. Moreover, it is set as a location whenever [predetermined crank angle / of the pressure-of-induction-pipe force sensor 30 which detects the pressure within / inhalation of air / the lower stream of a river of the heater member 4 of the inhalation-of-air path 6, and an engine]. To a sensor 14 and the ignition plug 16 which lights the gaseous mixture of the fuel supplied in the engine cylinder whenever [crank angle / which is one of the means which detects an engine speed] The ignition which supplies ignition energy with an ignition coil 17 and the power switch 18 based on an ignition signal, the coolant temperature sensor 15 which detects engine cooling water temperature, and the combustion pressure sensor 33 which detects the firing pressure in a cylinder are arranged in each proper location of said engine 100.
[0027] The signal of each sensor is inputted into a control unit 19, and the main-fuel injection valve 2, the upper fuel injection valve 3, the heater member 4, the heater relay 13, the ISC bulb 10, and the power switch 18 are controlled by the control unit 19. Although said oxygen density sensor 32 shows what outputs a-like proportionally signal to an exhaust air air-fuel ratio with the operation gestalt, inconvenience does not have that to which exhaust gas outputs two signals by the side of a rich side / Lean to theoretical air fuel ratio, either.
[0028] It outputs respectively the signal which performs closing motion of the upper fuel injection valve 3 and the main-fuel injection valve 2, drive of the heater member 4, drive of an ignition plug 16, closing motion of said idle speed control valve, etc. so that a control unit 19 may be arranged in a car body or an engine room, may perform predetermined data processing based on the electric signal outputted from said various sensors and may perform the optimal control for operational status. Moreover, a control unit 19 performs fuel control equipped with the study approach of an air-fuel ratio correction factor while performing Air Fuel Ratio Control and ignition control of the gaseous mixture supplied to the above-mentioned engine, and idle speed control (ISC).
[0029] drawing 2 -- a control unit 19 and gaseous mixture -- it is drawing having shown the internal configuration of a feeder 21. A control unit 19 changes into the signal for digital data processing the electric signal of each sensor installed in the engine. And the input/output interface which changes the control signal for a digital operation into the driving signal of an actual actuator (I/OLSI), The fuel quantity which distinguishes an

engine condition and an engine requires from the signal for digital data processing from I/OLSI, The processing unit which calculates ignition timing etc. based on the procedure which was able to be defined beforehand, and sends the calculated value to I/OLSI (MPU), It consists of volatile memory (RAM) in which the memory (EP-ROM) of the non-volatile in which the control procedure and controlled parameter of a processing unit were stored, the count result of a processing unit, etc. are stored.

[0030] Said I/OLSI changes the electric signal of various sensors, such as said inhalation air content sensor 7, said crank angle sensor 14, said cooling coolant temperature sensor 15, said pressure-of-induction-pipe force sensor 30, said oxygen density sensor 32, an ignition switch, battery voltage, and a clutch switch, into the signal for digital data processing.

[0031] It is transmitted to said I/OLSI while said processing unit (MPU) distinguishes the condition of an engine 100, calculates it based on the procedure to which the demand fuel quantity of this engine 100, ignition timing, etc. were beforehand set by said EP-ROM based on the signal for digital data processing changed by said I/OLSI and stores this count result in said RAM. And this I/OLSI changes the control signal for digital one into the driving signal of each actuator, and outputs each driving signal of a bulb opening command value, the 1st or the Nth cylinder fuel injection valve signal, the 1st, or the Nth cylinder ignition coil signal to an idle speed control valve, the upper fuel injection valve 3, the main-fuel injection valve 2, and an ignition plug 16. In addition, the backup power supply aiming at said ignition switch saving a memory content, even when a power source is not supplied to a control unit 19 in OFF may be connected to said RAM.

[0032] the gaseous mixture of said control unit 19 -- a supply function part -- gaseous mixture -- the abnormality judging means 22 in a feeder, and gaseous mixture -- it has the injection control means 1 which controls the feeder fail-safe means 23, the upper fuel injection valve 3, and the main-fuel injection valve 2, the heater control means 5, the path bulb control means 40 which controls the path bulb 10, and the ignition timing control means 41 which controls an ignition coil 17, and is constituted. moreover, drawing 2 -- setting -- gaseous mixture -- a feeder 21 is equipped with the upper fuel injection 3, the path bulb 10, the heater relay 13, the heater member 4, and the heater current detection means 20 that consists of resistance for heater current detection, and is constituted.

[0033] the gaseous mixture constituted as mentioned above hereafter -- actuation of the diagnostic equipment of a feeder 21 and its diagnostic approach is explained. first, gaseous mixture -- the gaseous mixture which detects failure of a feeder 21 -- drawing 3 thru/or drawing 5 explain the concrete approach of the abnormality judging means 22 in a feeder.

[0034] drawing 3 thru/or drawing 5 -- gaseous mixture -- it is drawing showing the concrete approach of the abnormality judging means 22 in a feeder. drawing 3 thru/or drawing 5 -- as an example -- gaseous mixture -- the feeder 21 equips with and constitutes the heater member 4 which makes all or some of injection fuel of the upper fuel injection valve 3 evaporate with heating as an evaporation means in the injection direction of the path bulb 10, the upper fuel injection valve 3, and said upper fuel injection valve 3.

[0035] In the above-mentioned configuration, the gaseous mixture especially by the evaporation means is not based on the description of gasolines, such as heavy and ****, but enlarges the amount of lags of ignition timing, raises an exhaust-gas temperature, and has the advantage that the discharge of a harmful hydrocarbon (HC) can be reduced after cold machine starting, by promoting the activity of a catalyst. Therefore, the condition of gaseous mixture appears in engine behavior most notably. Therefore, in order to detect the abnormalities of the condition of gaseous mixture quickly, it is most desirable to catch engine behavior. Moreover, as other approaches, the condition of gaseous mixture may be judged also of the combustion condition of the engine by gaseous mixture, and an exhaust gas component.

[0036] drawing 3 -- after engine starting -- gaseous mixture -- it is drawing showing the behavior of an engine speed when supplying gaseous mixture from the feeder. this drawing -- setting -- a continuous line -- gaseous mixture -- when there are no abnormalities in a supply means, it is behavior in case a certain problem has a broken line, and becomes larger than the case where the variation of engine-speed N is satisfactory.

[0037] said gaseous mixture -- the case where a condition detection means is detection of an engine speed -- said gaseous mixture -- a judgment means to judge the abnormalities of a supply means How to detect by maximum change width-of-face deltaN of the engine speed during the predetermined period (tmm) shown in drawing 3 , or predetermined time -- (-- there is an approach of detecting the magnitude (dN) of the variation of per dt) and judging in the magnitude of maximum deltadNm within predetermined time (tmm) or the approach of judging in the magnitude of the amount (dNmea) of deflection from a target engine speed (Nmea), as shown in drawing 4 . Since combustion may get worse, you may make it judge only a specific gas column according to the magnitude of the surge generated between predetermined time (tmm) from the fluctuation difference of the combustion between gas columns not only in this but others.

[0038] the time of being drawing having shown the behavior of the engine speed at the time of drawing 5 energizing a heater with starting cranking, and making it start by the upper fuel injection valve 3, for example, not reaching among less than 20 seconds at 20 degrees C or more of ordinary temperature, and an engine speed not reaching a predetermined value in the time of very low temperature less than after [cranking initiation] 5 to 10 seconds in the predetermined period beforehand set up from cranking, for example, an OAT, -- gaseous mixture -- it judges that a feeder 21 is unusual.

[0039] drawing 6 -- gaseous mixture -- it is drawing showing further the concrete approach of the abnormality judging means 22 in a feeder in a detail. First, it is made to inject and start with starting cranking by the starter, as the main-fuel injection valve 2 shows to drawing 6 (c). this reason -- the gaseous mixture from starting -- since it supplies from the upstream of the main-fuel injection valve 2 when supplying gaseous mixture only by the feeder 21, the inlet-pipe volume to a cylinder is large, and a transportation lag arises and it is because there is a problem that starting takes time amount. after [then,] starting

it is effective in the ability to shorten starting time amount by considering as the approach of switching to supply of the gaseous mixture from a feeder 21. moreover -- since it diagnoses by switching to the upper fuel injection valve 3 when judged with said main-fuel supply means judging by the main-fuel injection valve 2 being normal -- a certain abnormalities of said main-fuel supply means -- gaseous mixture -- it can prevent that the abnormality judging of a supply means carries out a misjudgment law in response to effect.

[0040] A fuel is supplied by the upper fuel injection valve 3 from cranking, and when it reaches among less than 20 seconds at 20 degrees C or more of ordinary temperature and an engine speed reaches a predetermined more than value (high-order detonation judging level), for example, 800 r/min, in the time of very low temperature less than after [cranking initiation] 5 to 10 seconds in the predetermined period set up beforehand, for example, an OAT, it judges with the fuel-supply means of the main-fuel injection valve 2 being normal with a main-fuel supply judging means. When an engine speed does not reach a predetermined value between said predetermined periods, it judges that the device except [this] relating to the main-fuel injection valve 2 or main-fuel injection etc. is unusual. After being judged with the main-fuel injection valve 2 being normal, as shown in the continuous line of drawing 6 (c), the quantity of the assignment of injection of the main-fuel injection valve 2 is decreased gradually, and, finally it stops. On the other hand, if injection by the upper fuel injection valve 3 is gradually started as shown in the continuous line of drawing 6 (d) After starting is supplying an evaporation fuel by the upper fuel injection valve 3 further, without getting worse startability, since there is no fuel inflow delay to a cylinder rather than the time of starting by the upper fuel injection valve 3. Compared with the case where it injects by the main-fuel injection valve 2, the adhesion fuels to an inhalation-of-air path decrease in number, and since combustion stability improves, an improvement of combustion can be aimed at. Moreover, at this time, as shown in drawing 6 (b), the energization to the heater member 4 is started to the injection initiation and coincidence by the upper fuel injection valve 3.

[0041] After injection initiation of said upper fuel injection valve 3 carries out lag amendment of ignition timing, as shown in drawing 6 (e), it raises an exhaust-gas temperature, and can promote the activity of a catalyst. In consideration of the power consumption of the heater member 4, for dozens of seconds from after cold machine starting to catalytic activity, it injects by the energization to the heater member 4, and the upper fuel injection valve 3, and the activity of a catalyst is promoted. After that, although not illustrated, it injects by stopping injection of the upper fuel injection valve 3, and the energization to the heater member 4, by the time it starts transit, and switching to the main-fuel injection valve 2.

[0042] Although the change means of said main-fuel injection valve 2 and upper fuel injection valve 3 controls fuel quantity gradually to become independent fuel supply, respectively, if it has set up many fuel-supply assignments of the injection valve of the direction which may set up the so-called invalid pulse width which cannot supply fuel quantity, and is mainly supplied even if it gives pulse width in fact when control of fuel

quantity is given as injection pulse width, it can be said to be a change means.
[0043] the gaseous mixture to which the behavior shown as a continuous line changes from the upper fuel injection valve 3 in the engine speed of drawing 6 (a) -- the case where there is no engine-performance top problem of 21 feeder is shown. From the time of carrying out lag amendment of the ignition timing shown by drawing 6 (e) after injection initiation of the upper fuel injection valve 3 to the specified quantity, maximum change width-of-face deltaN1 of the engine speed within the predetermined period set up by tmm is detected after predetermined tmd.
[0044] the gaseous mixture to which the broken line of drawing 6 (a) changes from the upper fuel injection valve 3 on the other hand -- a feeder 21 The abnormalities of the heater relation by reduction of the evaporation fuel supplied from the upper fuel injection valve 3 by degradation of a heater, open circuit of the current supply system to the heater member 4, etc. Or a flow passage area decreases by mixing and deposition of cutoff of the fuel-supply path to the upper fuel injection valve 3, or the foreign matter to a fuel injection valve, and fuel oil consumption decreases, Are behavior in case there is a certain problem, and it becomes larger than the case where the variation of a rotational frequency is satisfactory. From the time of carrying out lag amendment of the ignition timing shown by drawing 6 (e) to the specified quantity (drtd), maximum change width-of-face deltaN2 of the engine speed within the predetermined period set up by tmm after predetermined tmd is detected. therefore, gaseous mixture -- failure of a feeder 21 can be judged in the magnitude of the maximum change width of face of an engine speed. if the maximum change width of face between this tmm is set to deltaN -- deltaN1 -- < -- deltaN2 -- becoming -- the magnitude of deltaN -- gaseous mixture -- the abnormal condition of a feeder 21, for example, degradation of a heater, -- comparatively -- ** -- it has correlation.
[0045] Drawing 7 is drawing showing the relation between engine-speed variation deltaN and whenever [degradation]. It judges with it being so unusual that whenever [degradation] being large as shown in drawing 7 . In this case, whenever [said engine-speed variation deltaN and degradation] is in proportionality mostly, and whenever [degradation] is given with the predetermined function of deltaN. Therefore, the influential value is beforehand set as the exhaust air engine performance or engine operation as a decision value SLne, and when deltaN exceeding this is detected, it is made to judge with it being unusual. Or according to deltaN, it asks for whenever [degradation] gradually, and when whenever [predetermined degradation / which has been set up beforehand] is exceeded, it can also consider as an abnormality judging.
[0046] drawing 8 and drawing 9 -- gaseous mixture -- it is drawing showing further the concrete approach of the abnormality judging means 22 in a feeder in a detail. Drawing 8 from the time of carrying out lag amendment of the ignition timing shown by drawing 8 (e) after injection initiation of the upper fuel injection valve 3 to the specified quantity like drawing 6 Said mixed gaseous state voice detection means other than the engine speed during the predetermined period set up by tmm after predetermined tmd, for example, the

drawing 8 (h) torque value, drawing 8 (i) HC concentration, etc. -- being based -- said gaseous mixture -- how to detect the abnormal condition of a feeder 21 is shown.

[0047] The pressure-of-induction-pipe force sensor 30 by which the pressure-of-induction-pipe force is installed in an inlet pipe, the combustion pressure sensor 33 by which combustion pressure is installed near a combustion chamber, the torque sensor by which torque value is installed in an engine output shaft, and HC concentration are detected by HC sensor attached in the exhaust pipe of an engine 100. the behavior shown as a continuous line like drawing 6 , respectively -- said gaseous mixture -- the case where there is no feeder 21 an engine-performance top problem -- a broken line -- said gaseous mixture -- behavior in case a certain problem has a feeder 21 is shown. When there is nothing a problem, the mixed gaseous state voice detection means which showed lag amendment of the ignition timing shown by drawing 8 (e) from the time of carrying out to the specified quantity like the case of drawing 6 in drawing 8 during the predetermined period set up by tmm after predetermined tmd (f) - a Fig. (i) has little variation respectively. however -- since each variation becomes larger than the case of being satisfactory when there is a certain problem -- the magnitude of variation -- said gaseous mixture -- failure of a feeder 21 can be judged.

[0048] Drawing 10 is drawing showing the relation between the variation of each parameter, and whenever [degradation], and drawing 10 (f) - (i) supports drawing 9 (j) which drawing 10 (j) and (k) mention later, and (k) again at said drawing 8 (f) - (i), respectively. first, the case where it detects by variation deltaPm of the pressure-of-induction-pipe force of drawing 8 (f) -- the magnitude of deltaPm -- gaseous mixture -- it has whenever [abnormal-condition / of a feeder 21 /, for example, degradation of heater,], and correlation.

[0049] Drawing 10 (f) is what showed the relation between the aforementioned deltaPm and whenever [degradation], the aforementioned deltaPm and whenever [degradation] have it in proportionality mostly in this case, and whenever [degradation] is given with the predetermined function of deltaPm. Therefore, when deltaPm exceeding threshold SLPm set up beforehand is detected, it is made to judge with it being unusual. Or according to deltaPm, it asks for whenever [degradation] gradually, and when whenever [predetermined degradation / which has been set up beforehand] is exceeded, it can also consider as an abnormality judging.

[0050] the case where similarly it detects by variation deltaPi of the drawing 8 (g) combustion pressure, or variation deltaTq of the drawing 8 (h) torque value -- the magnitude of delta Pi and delta Tq -- gaseous mixture -- it has whenever [abnormal-condition / of a feeder 21 /, for example, degradation of heater,], and correlation. Drawing 10 (g) and (h) are what showed the relation between the magnitude of Above delta Pi and delta Tq, and whenever [degradation], and whenever [degradation] is given with a predetermined function, respectively. Therefore, when threshold SLPi set up beforehand, and delta Pi and delta Tq exceeding SLTq are detected, it is made to judge with it being unusual.

[0051] Moreover, HC concentration of drawing 8 (i) is attached in an exhaust pipe, and detects an exhaust air component. As mentioned above, by the air-fuel ratio sensor 32, the output by the side of Lean may be carried out also in the state of a flame failure in property, and there is a problem that abnormalities cannot be detected if the ratio of a fuel suits air as an air-fuel ratio even when unsuitable as gaseous mixture. Moreover, in an operating period including starting cranking, since an engine began to have rotated by himself, combustion was the transient field which carries out big change, it was difficult to detect aggravation of a combustion condition quickly, and there was a problem of incorrect-detecting in diagnosing based on an air-fuel ratio. HC concentration can catch more quickly than the air-fuel ratio sensor 32 that gaseous mixture affects combustion, a combustion condition changes, and an exhaust air component changes as a result by detecting an exhaust air component, and the abnormality judging of gaseous mixture is possible for it. The relation between whenever [degradation / in the case of detecting by change deltaHC of HC concentration], and a decision value (SLHC) is shown in drawing 10 (i).

[0052] Moreover, as a sensor which detects an exhaust air component, it is possible to judge the abnormalities of gaseous mixture by change of the concentration which the NOx sensor and CO sensor which are not illustrated also have and was detected similarly here. Although not furthermore illustrated, when the exhaust air temperature sensor is attached in the exhaust pipe, it is also possible to detect that gaseous mixture affects combustion, a combustion condition changes, and an exhaust-gas temperature changes as a result, and to judge the abnormalities of gaseous mixture.

[0053] Drawing 9 shows the case where a target revolving-speed-control means to control said supplementary air path bulb 10 to become a predetermined target engine speed is established, after being judged in drawing 8 to be the supplementary air path [which bypasses a throttle valve 8 further] 9, supplementary air path bulb [which adjusts the air content of said supplementary air path 9] 10, and said internal combustion engine's starting back. the behavior shown as a continuous line like drawing 9 , respectively -- said gaseous mixture -- the case where there is no feeder 21 an engine-performance top problem -- a broken line -- said gaseous mixture -- behavior in case a certain problem has a feeder 21 is shown. If lag amendment of ignition timing is carried out to the specified quantity in the state of target revolving speed control, in order to maintain a rotational frequency, in order to take out torque, an air content increases, and fuel quantity increases as a result. With this configuration, it judges that said upper fuel injection valve 3, the heater member 4, the supplementary air path bulb 10, or plurality is unusual.

[0054] first -- the air flow rate shown by drawing 9 (j) -- said gaseous mixture -- since it controls to make bypass air contents, such as the supplementary air path bulb (ISC bulb) 10, increase, and to maintain a target engine speed, since an engine speed will fall from a target engine speed if a certain problem has a feeder 21, an air content increases. therefore, change of the air content (Qa) within the predetermined period set up by tmm after predetermined tmd from the time of carrying out lag amendment of the ignition timing

shown by drawing 9 (e) to the specified quantity -- detecting -- making -- for example, the magnitude of the maximum change width of face (deltaQa) -- gaseous mixture -- failure of a feeder 21 can be judged. deltaQa2 detected when the maximum change width of face between this tmm is set to deltaQa and there are deltaQa1 detected when there is nothing an engine-performance top problem, and a certain problem -- deltaQa1<deltaQa2 -- becoming -- the magnitude of deltaQa -- gaseous mixture -- it has whenever [abnormal-condition / of a feeder 21 /, for example, degradation of heater,], and correlation. Drawing 10 (j) is what showed the relation between the aforementioned deltaQa and whenever [degradation], the aforementioned deltaQa and whenever [degradation] have it in proportionality mostly in this case, and whenever [degradation] is given with the predetermined function of deltaQa. Therefore, when deltaQa exceeding this is detected, it is made to judge with it being unusual. Or according to deltaQa, it asks for whenever [degradation] gradually, and when whenever [predetermined degradation / which has been set up beforehand] is exceeded, it can also consider as an abnormality judging.

[0055] Moreover, although change of Qa is detected, the controlled variable of bypass air contents, such as the ISC bulb 10, is detected as increment deltaBA between tmm(s) after said tmd progress on the basis of the controlled variable before carrying out the lag of said ignition timing, the abnormality decision value SLba is beforehand set as it, and you may make it ask for whenever [degradation] according to this.

[0056] Similarly, the relation between whenever [degradation / in the case of detecting by change deltaqf of the cylinder inflow fuel quantity of drawing 9 (k)], and a decision value (SLqf) is shown in drawing 10 (k). You may make it change of the valve-opening time amount (ms) of the fuel quantity (g/min) currently calculated by the control unit or the upper fuel injection valve 3 detect detection of qf here.

[0057] moreover -- even if an engine speed reaches a predetermined value when it is made to start by the upper fuel injection valve 3 as said drawing 3 showed -- gaseous mixture -- it may be unable to decide that the fuel-supply means of a feeder 21 is normal For example, when whenever [degradation] is small, the conditions of said rotational frequency will be satisfied. Then, when whenever [predetermined degradation / which has been set up beforehand] is exceeded, it is made to judge with it being unusual by detecting the magnitude of the change width of face of an engine speed mentioned above, if lag amendment of the ignition timing shown by said drawing 8 (e) is carried out to the specified quantity as a next phase. When it is judged that the abnormality judging was decided, the amount of lags of ignition timing is stopped, and a fail-safe means to mention later is carried out and it controls to switch to the fuel-supply means by said main-fuel injection valve 2.

[0058] drawing 11 -- gaseous mixture -- it is drawing showing further the concrete approach of the abnormality judging means 22 in a feeder in a detail, and the application to drawing 6 is shown. carrying out continuously lag amendment of the ignition timing shown by drawing 6 (e) to the specified quantity after injection initiation of said upper fuel injection valve 3 in said drawing 6 -- receiving -- drawing 11 -- the lag of ignition timing -- a

predetermined time (n) time -- dividing -- carrying out -- change of the engine speed in the steady state of each ignition timing -- detecting -- said gaseous mixture -- a feeder 21 is abnormal -- it is -- how to judge degradation is shown.

[0059] First, after injection switching to the upper fuel injection valve 3, the lag of the ignition timing is gradually carried out to the specified quantity (drt1), and the condition is maintained. From the time of carrying out predetermined time (tmd) progress, maximum change width-of-face deltaNid1 of the engine speed within the predetermined period set up by tm1 is detected.

[0060] Drawing 12 is drawing showing maximum change width-of-face deltaNid and the abnormality decision value dNB. In drawing 12 , the abnormality decision value dNB set up beforehand is indicated to be said maximum change width-of-face deltaNid, and dNB is more greatly set up with allowances to the maximum range of fluctuation dNA in the case of being in the normal range. if it is deltaNid1<dNB detected in said range of tm1 -- said gaseous mixture -- as a thing without the abnormalities of a feeder 21, the lag of the ignition timing is succeedingly carried out to the specified quantity (drt2) gradually, and the condition is maintained. From the time of carrying out predetermined time (tmd) progress, maximum change width-of-face deltaNid2 of the engine speed within the predetermined period set up by tm2 is detected. if it is deltaNid2<dNB -- said gaseous mixture -- as a thing without the abnormalities of a feeder 21, the lag of the ignition timing is succeedingly carried out to the specified quantity (drtn) gradually, and the condition is maintained. From the time of carrying out predetermined time (tmd) progress, maximum change width-of-face deltaNidn of the engine speed within the predetermined period similarly set up by tmn is detected, and a lag is carried out to the amount drtd of last demand lags in a predetermined time (n) step. if there is no rotational frequency change it will be changeless to deltaNidn>=dNB by the time it carries out a lag to drtd -- said gaseous mixture -- if a feeder 21 judges with it being normal and serves as deltaNidn>=dNB at the time of an intermediate lag, it will judge with abnormalities. Moreover, if total time amount sigmadtm until it reaches the amount (drtd) of demand ignition timing lags in the case of activation is not the short time amount for less than 20 seconds, since the emission temperature rise effectiveness by the lag will fall and exhaust gas will get worse, it is necessary to suit each time setting of a number of fractionation (n), and said tmd and tmn. A setup whose sigmadtm is about 5 - 10 seconds is about desirable n= 2 to 3 times.

[0061] deltaNidn in each phase of the lag which amounts to n times of the ignition timing by drawing 11 to drawing 13 being drawing showing the map of whenever [amount of lags, deltaNid, and degradation], and said drawing 12 carrying out only an abnormality judging -- receiving -- whenever [the relation between the amount of lags, and deltaNid to / degradation] -- as a map format -- beforehand -- setting up -- this -- responding -- each phase of a lag -- it is -- said gaseous mixture -- it is the approach of judging the degradation condition of a feeder 21. For example, also by 100 r/min, deltaNid in case whenever [degradation] is large as for deltaNid detected when it is 5 degrees with the small amount

of lags and it is 20 degrees with the large amount of lags also in 100 r/min is set up so that whenever [degradation] may be given small. You may make it ask for change of an engine speed like [here] the case in said drawing 6 by detecting the magnitude of the amount (dNmea) of deflection from the approach of detecting in the magnitude of maximum deltadNm of the variation per predetermined time besides deltaNid, or a target engine speed.

[0062] With a means to carry out continuously lag amendment of the ignition timing shown by said drawing 6 to the specified quantity in the diagnostic equipment constituted like the above-mentioned When whenever [upper fuel injection valve's 3 degradation] is large (for example, intense degradation, an open circuit of a heater, extreme short supply of a fuel, etc.) The judgment of whenever [degradation] can be performed detecting the combustion condition over the amount of lags by carrying out a lag gradually to combustion getting worse and resulting in the increment in the discharge of a hydrocarbon, and the worst engine stall, before completing a lag. Therefore, it can prevent the increment in the extreme discharge of a hydrocarbon, and resulting in the worst engine stall.

[0063] Drawing 14 is drawing showing how to judge abnormalities by air flow Q a. Since it will control to maintain a target rotational frequency to be shown in drawing 14 if the lag of the ignition timing is carried out, an air content increases. Therefore, when the increment (dQa) of the air content according to the amount of lags of ignition timing crosses decision value Rhine dQaB beforehand set up as the table value over the amount of ignition lags, or a function with whenever [allowances] to Rhine dQaA for which always [forward] is asked, it judges with it being unusual.

[0064] By the same view as the abnormality judging approach explained by above-mentioned drawing 12 thru/or drawing 14 According to the amount of ignition timing lags, they are other mixed gaseous state voice detection means like the case where it is said drawing 8 although not illustrated. For example, when setting up variation deltaPm of the pressure-of-induction-pipe force, and abnormality judging Rhine according to a changed part, or even when setting up abnormality judging Rhine according to change deltaqf of cylinder inflow fuel quantity, or a changed part, whenever [abnormality or degradation] can be judged.

[0065] next, the others immediately after starting -- the time of other stationaries -- operational status -- said gaseous mixture -- how to judge the abnormalities of a feeder 21 and degradation is explained with reference to drawing 15 thru/or drawing 17 . drawing 15 and drawing 16 -- the time of a stationary -- operational status -- gaseous mixture -- it is drawing showing how to judge the abnormalities of a feeder.

[0066] In drawing 15 , it is regular and the change which shifts to operation by upper fuel injection valve 3 independent one from the condition currently operated by main-fuel injection valve 2 independent ones is prepared compulsorily. The change of this operational status shall be set as a field with little effect in operability, for example, is set as a high rotation heavy load field. Moreover, when operating by main-fuel injection valve 2 independent one, it is made to switch an injection valve by the premise to be judged with

it being normal. maximum change width-of-face deltaN of the engine speed within the predetermined period set up by tmm after tmd2 predetermined like [after switching an injection valve] the case where it is shown in said drawing 6 -- gaseous mixture -- failure of a feeder 21 is judged in the magnitude of the maximum change width of face of an engine speed. After switching, it shall return to operation by main-fuel injection valve 2 independent one again after tck time amount progress. However, when change it is changeless to delta N>delta N3 is detected, it returns to operation by main-fuel injection valve 2 independent one immediately and remarkable abnormalities are detected also before tck time amount progress, it is [as shown in drawing 16 ,] made to carry out a fail-safe means to mention later.

[0067] drawing 17 -- change of battery voltage -- gaseous mixture -- the time of performing the change which shifts to operation by upper fuel injection valve 3 independent one from the condition currently operated by main-fuel injection valve 2 independent one as been drawing showing the abnormality judging approach of a feeder, for example, shown in said drawing 6 , drawing 8 , drawing 9 , drawing 15 , and drawing 16 -- change of battery voltage (VB) -- said gaseous mixture -- how to judge the abnormalities of a feeder 21 and degradation is shown.

[0068] Since a heater shifts to ON (energization) from OFF (un-energizing) and the heater current is consumed in the case of the change of this operational status, battery voltage (VB) falls. Since the heater current serves as max at the time of ON, abnormalities and degradation can be judged by detecting the magnitude of the maximum (dvb) of the maximum change width of face (deltaVB) of VB at the time of carrying out heater-on, or rate of change. For example, when having not deteriorated, the consumed electric current at the time of inrush of a heater is large, and is in the inclination for the change width of face of VB to also become large.

[0069] Drawing 18 is drawing showing the relation of whenever [battery voltage change and degradation]. Moreover, it has an almost inverse proportion-[whenever / the aforementioned deltaVB and whenever / degradation] relation, and whenever [degradation] is given with the predetermined function of deltaVB. Therefore, when deltaVB which does not exceed the predetermined decision value SLvb is detected, it is made to judge with it being unusual. In this case, since deltaVB value is greatly detected when the dc-battery itself has deteriorated, or when not charging enough, that it must be careful may judge with it being normal, although the heater has deteriorated in practice. Therefore, when the dc-battery VB in case a heater is OFF is in the 14V neighborhood at the time of more than 12V and an AC-dynamo generation of electrical energy at the time of an engine shutdown, it is important to judge by change of battery voltage (VB) by making to be judged with a dc-battery being normal into a requirement.

[0070] said gaseous mixture by the heater current value in the case of drawing 19 being drawing showing the relation between the heater current and heater-on time amount, being a configuration in said drawing 2 , and having the heater current detection means 20 -- how to judge the abnormalities of a feeder 21 and degradation is shown.

[0071] If the elapsed time after turning on from a heater-off (un-energizing) condition (energization) is taken along an axis of abscissa, always [forward], the heater current value detected will take the value below a predetermined current (this [for example, / 200 A-phase / under]) by making immediately after ON into maximum. Therefore, when the decision values SLap1, SLap2, and SLap3 of a current value are set up by the three-stage of tda1, tda2, and tda3, respectively and it is over this time longer than predetermined time (tmng1) in each phase by this operation gestalt according to elapsed time, it is made to judge with it being unusual. Although it is good also as one SLap1 value which aimed at maximum and a decision value may be increased from a three-stage here, when it asks from change of the heater current, 2 - a three-stage are desirable. Moreover, since a current value changes according to the adhesion fuel quantity to the heater by fuel oil consumption, if a setting setup of the decision values SLap1, SLap2, and SLap3 is beforehand carried out according to fuel oil consumption, coexistence of prevention of improvement and an incorrect diagnosis of the precision of a judgment is possible.

[0072] Drawing 20 is drawing showing the fail-safe approach at the time of carrying out a degradation judging. each of said gaseous mixture mentioned above -- abnormal by the approach of judging the abnormalities of a feeder 21, and degradation -- it is -- the fail-safe approach at the time of judging with degradation is shown, and how exhaust gas attains aggravation prevention are indicated at least to be reservation of engine starting, and an engine's continuation of operation.

[0073] it is shown in drawing 20 (d) -- as -- once -- the upper fuel injection valve 3 -- independent or gaseous mixture, when operated with a fuel-supply means to set up many fuel-supply assignments by the feeder 21 The amount of lags of ignition timing to promote the activity of the catalyst shown by drawing 20 (e), when it is judged that the abnormality judging was decided is stopped. Said main-fuel injection valve 2 independent which ignition timing is controlled to stop a lag and is shown in drawing 20 (c) after ignition timing is controlled in order to reduce the shock by the change of a fuel-supply means or said gaseous mixture -- it controls to switch the fuel-supply assignment of the main-fuel injection valve 2 to a fuel-supply means to set up mostly, from a feeder 21. Moreover, energization of the heater shown in drawing 20 (b) sets up time amount (dltm2) until it turns off a heater from abnormality judging decision so that it turns off immediately, and OFF time amount can be alternatively set up by the result of an abnormality judging, since the way may be good, when it is better to turn off after making the fuel injected by the upper fuel injection valve 3 evaporate, and when said heater current is detected with abnormalities.

[0074] Although the operation gestalt of the diagnostic equipment described above explained the fuel injection valve prepared near a suction port as a main-fuel injection valve 2, it may be made to use the main-fuel injection valve 2 as the injection valve which injects a direct fuel to a combustion chamber, and the diagnostic approach and effectiveness are the same.

[0075] next, the gaseous mixture in the operation gestalt mentioned above -- abnormality

judging control of a feeder 21 is explained. drawing 21 -- gaseous mixture -- it is the flow chart which shows abnormality judging processing of a feeder 21, and every predetermined time (for example, 10ms) starts and performs from the main routine which is not illustrated in the processing unit (MPU) of a control unit 19.

[0076] first, the step 1000 -- the change means of a fuel-supply means -- gaseous mixture -- it confirms whether to be injection by whether injection by the feeder 21 is performed, and the main-fuel injection valve 2. change conditions -- being materialized -- gaseous mixture -- when are judged with injection by the feeder 21, and it progresses to step 1100 and is judged with injection by the main-fuel injection valve 2, it progresses to step 2000.

[0077] At step 2000, injection by the main-fuel injection valve 2 is carried out. the routine last at step 2100 -- gaseous mixture -- if injection by the feeder 21 is performed -- gaseous mixture -- the injection quantity of a feeder 21 is decreased. Subsequently, it confirms whether a starter is ON at step 2200, and when a starter is OFF, it progresses to step 2300 as it is. If a starter is judged at step 2200 to be ON, it will set up so that injection at the time of starting may be carried out at step 2210, and will progress to step 2300.

[0078] At step 2300, it is confirmed whether the predetermined combustion condition was reached. When a predetermined combustion condition, for example, an engine speed, reaches 800 r/min, it judges with the main-fuel injection valve 2 being normal at step 2400, and when not reaching a predetermined combustion condition, this routine is ended as it is.

[0079] on the other hand -- the above-mentioned step 1000 -- gaseous mixture -- when it is judged with injection by the feeder 21 and progresses to step 1100, it is confirmed at step 1100 whether the main-fuel injection valve 2 is normal. If not judged with the main-fuel injection valve 2 being normal at step 1100, this routine is ended as it is. If judged with the main-fuel injection valve 2 being normal, it will progress to step 1200.

[0080] step 1200 -- gaseous mixture -- although carry out injection by the feeder 21 and it is not illustrated, it controls making a heater energize etc. to coincidence. Subsequently, at step 1300, the quantity of the injection quantity of the main-fuel injection valve 2 is decreased until it becomes a halt or a value near 0 gradually.

[0081] At step 1400, lag amendment of ignition timing is carried out and it is confirmed whether the amount of lag amendments reached to the specified quantity at step 1500. This routine started for every predetermined time is repeated until it ends this routine as it is and reaches the specified quantity, if it has not reached to the specified quantity.

[0082] When the amount of lag amendments reaches to the specified quantity, the change width of face (deltaN) of a rotational frequency is calculated at step 1600. The operation of step 1600 is detected as variation per unit time amount (for example, for 40ms) between the predetermined time measured from the time of said amount of lag amendments reaching to the specified quantity.

[0083] At step 1700, it is confirmed whether the value of the aforementioned deltaN is larger than the predetermined value set up beforehand. If this routine which ends this routine as it is and is started for every predetermined time is repeated if it has not reached to the predetermined value, and it has never reached between predetermined time, it is

judged with an upper fuel injection equipment being normal by another routine which is not illustrated.

[0084] the case where it reaches to the specified quantity at the above-mentioned step 1700 -- step 1800 -- gaseous mixture -- the abnormalities of a feeder 21 are judged and a predetermined judgment result flag etc. is set. step 1900 -- gaseous mixture -- the processing which interrupts injection of a feeder 21, lag amendment of ignition timing, energization of a heater, etc. carries out -- having -- step 1910 -- further -- gaseous mixture -- processing which forbids injection of a feeder 21 and lag amendment of ignition timing henceforth is carried out, and this routine is ended.

[0085] the gaseous mixture which mainly detects the condition of gaseous mixture above -- a condition detection means and a detection result -- being based -- gaseous mixture -- although a judgment means to judge the abnormalities of a supply means was explained -- this means -- gaseous mixture -- the time of judging with a condition being bad -- said gaseous mixture -- the gaseous mixture judged to be the abnormalities of a feeder 21 -- it is the diagnostic approach of a feeder 21.

[0086] Moreover, besides the evaporation at the electric-type heater energized to a heater member which was mentioned above, evaporation means may be any of the heater evaporation by heat of combustion, the evaporation by supersonic vibration, the evaporation by warm water use, and the evaporation by exhaust-gas-temperature use, and can be applied except for the example by drawing 19 from drawing 17 .

[0087] it explained to the detail above -- as -- the gaseous mixture of this operation gestalt -- the diagnostic equipment and its diagnostic approach of a feeder With the main-fuel injection valve 2 which supplies a fuel to an internal combustion engine, the upper fuel injection valve 3 which supplies a fuel to the upstream from the main-fuel injection valve 2, and an evaporation means to evaporate the fuel from the upper fuel injection valve 3 In a feeder the gaseous mixture which supplies gaseous mixture from the upstream of the main-fuel injection valve 2 -- the gaseous mixture of the internal combustion engine which established the supply means -- the condition of gaseous mixture when supplying gaseous mixture -- variation detection results, such as an engine rotational frequency, -- being based -- detecting -- the variation of a detection result etc. -- being based -- gaseous mixture, when it has an abnormality judging means 22 to judge the abnormalities of a supply means and is judged with abnormalities the fuel supplied from the upper fuel injection valve 3 -- stopping -- and the change to the main-fuel injection valve 2, a halt of an evaporation means, and amendment of ignition timing -- immediately -- or, since it had further the fail-safe control means 23 performed gradually and it was constituted gaseous mixture -- even when the abnormalities of a feeder 21 occur and enough evaporation fuels are no longer supplied, there are not reservation of engine starting and a problem which results in an engine stall at least, and operation of an engine can be continued, and aggravation of exhaust gas can be prevented. thereby -- gaseous mixture -- the abnormalities of a supply means -- gaseous mixture -- when enough evaporation fuels are no longer supplied from a feeder, it can prevent beforehand the improvement effect of combustion no longer being

demonstrated and resulting in an engine stall, without [the increment in the discharge of a hydrocarbon, and] the ability carrying out the worst combustion.

[0088] As mentioned above, although 1 operation gestalt of this invention was explained in full detail, this invention is not limited to said each operation gestalt, is the range which does not deviate from the pneuma of invention indicated by the claim, and can perform various modification in a design.

[0089]

[Effect of the Invention] the gaseous mixture which starts this invention so that I may be understood from the above explanation -- the diagnostic equipment and its diagnostic approach of a feeder -- gaseous mixture -- the gaseous mixture which it can judge with abnormalities, and there are not reservation of engine starting and a problem which results in an engine stall at least, and operation of an engine can be continued, and can prevent aggravation of exhaust gas when abnormalities are in the gaseous mixture by the feeder -- a feeder can be supplied.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] the gaseous mixture of the operation gestalt of the operation gestalt of this invention -- drawing having shown the engine structure of a system equipped with the diagnostic equipment of a feeder.

[Drawing 2] the gaseous mixture of this operation gestalt -- the control unit of the diagnostic equipment of a feeder, and gaseous mixture -- drawing having shown the internal configuration of a feeder.

[Drawing 3] the gaseous mixture of this operation gestalt -- the gaseous mixture of the diagnostic equipment of a feeder -- drawing showing the concrete approach of the abnormality judging means in a feeder.

[Drawing 4] the gaseous mixture of this operation gestalt -- the gaseous mixture of the diagnostic equipment of a feeder -- drawing showing the concrete approach of the abnormality judging means in a feeder.

[Drawing 5] the gaseous mixture of this operation gestalt -- the gaseous mixture of the diagnostic equipment of a feeder -- drawing showing the concrete approach of the abnormality judging means in a feeder.

[Drawing 6] the gaseous mixture of this operation gestalt -- the gaseous mixture of the diagnostic equipment of a feeder -- drawing showing further the concrete approach of the abnormality judging means in a feeder in a detail.

[Drawing 7] the gaseous mixture of this operation gestalt -- drawing showing the relation between engine-speed variation deltaN of the diagnostic equipment of a feeder, and whenever [degradation].

[Drawing 8] the gaseous mixture of this operation gestalt -- the gaseous mixture of the diagnostic equipment of a feeder -- drawing showing further the concrete approach of the

abnormality judging means in a feeder in a detail.
[Drawing 9] the gaseous mixture of this operation gestalt -- the gaseous mixture of the diagnostic equipment of a feeder -- drawing showing further the concrete approach of the abnormality judging means in a feeder in a detail.
[Drawing 10] the gaseous mixture of this operation gestalt -- drawing showing the relation between the variation of each parameter of the diagnostic equipment of a feeder, and whenever [degradation].
[Drawing 11] the gaseous mixture of this operation gestalt -- the gaseous mixture of the diagnostic equipment of a feeder -- drawing showing further the concrete approach of the abnormality judging means in a feeder in a detail.
[Drawing 12] the gaseous mixture of this operation gestalt -- drawing showing maximum change width-of-face deltaNid and the abnormality decision value dNB of diagnostic equipment of a feeder.
[Drawing 13] the gaseous mixture of this operation gestalt -- drawing showing the map of whenever [amount / of the diagnostic equipment of a feeder / of lags, deltaNid, and degradation].
[Drawing 14] the gaseous mixture of this operation gestalt -- drawing showing how to judge abnormalities by air flow Q a of the diagnostic equipment of a feeder.
[Drawing 15] the gaseous mixture of this operation gestalt -- the time of the stationary of the diagnostic equipment of a feeder -- operational status -- gaseous mixture -- drawing showing how to judge the abnormalities of a feeder.
[Drawing 16] the gaseous mixture of this operation gestalt -- the time of the stationary of the diagnostic equipment of a feeder -- operational status -- gaseous mixture -- drawing showing how to judge the abnormalities of a feeder.
[Drawing 17] the gaseous mixture of this operation gestalt -- change of the battery voltage of the diagnostic equipment of a feeder -- gaseous mixture -- drawing showing the abnormality judging approach of a feeder.
[Drawing 18] the gaseous mixture of this operation gestalt -- drawing showing the relation of whenever [battery voltage change / of the diagnostic equipment of a feeder /, and degradation].
[Drawing 19] the gaseous mixture of this operation gestalt -- drawing showing the relation between the heater current of the diagnostic equipment of a feeder, and heater-on time amount.
[Drawing 20] the gaseous mixture of this operation gestalt -- drawing showing the fail-safe approach when the diagnostic equipment of a feeder carries out a degradation judging.
[Drawing 21] the gaseous mixture of this operation gestalt -- the gaseous mixture of the diagnostic equipment of a feeder -- the flow chart which shows abnormality judging processing of a feeder.
[Description of Notations]
1 -- Injection control means
2 -- Main-fuel injection valve

3 -- Upper fuel injection valve
4 -- Heater member
5 -- Heater control means
6 -- Inhalation-of-air path
7 -- Inhalation air content sensor
8 -- Throttle valve
9 -- Supplementary air path
10 -- ISC bulb
11 -- Air duct for atomization
13 -- Heater relay
19 -- Control unit
20 -- Heater current detection means
21 -- gaseous mixture -- a feeder
22 -- gaseous mixture -- the abnormality judging means in a feeder
23 -- gaseous mixture -- a feeder fail-safe means
40 -- Path bulb control means
41 -- Ignition timing control means